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ABSTRACT

This paper describes a model for the evaluation of the graduates of the teacher education programs of Tennessee Technological University. The use of the model in program development and improvement for the preparation of teachers, and its application to a special group of 20 individuals teaching science in the middle school grades are also presented. Graduates from the bachelor's and master's level program for the period 1973 through 1978 participated in the study. Information was collected on each subject from four sources: (1) self-evaluative data; (2) principals and supervisory evaluations; (3) satisfaction of students of the graduates; and (4) data from independent trained observers. The findings show that the graduates have exhibited many of the characteristics of good teachers; however, when compared with national samples, they are functioning near the mean. Use of the model in science education and how the findings of this study address the important consideration of program modification are also included. (Author/HM)

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FOLLOWUP STUDIES AT TENNESSEE TECHNOLOGICAL UNIVERSITY: A MODEL FOR TEACHER EVALUATION[1]

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Teacher evaluation has become a major concern of not only institutions of higher education but a variety of agencies and groups. In recent years emphasis has been placed on the importance of teacher evaluation at institutions of higher education for the purpose of program improvement. Teacher education is analogous to industry in that it needs to evaluate the "product," i.e., teacher education graduates, and to feed that evaluative information back into the program of preparation in order to improve the quality of the teaching profession.

The need for institutions of higher education to evaluate their teacher education programs was given emphasis when the 1970 standards for accreditation of teacher education were adopted by the National Council for Accreditation of Teacher Education (Standards, 1970). Evaluation and the use of the results for program improvement were given further emphasis in the standards that became effective January 1, 1979 (Standards, 1977). Standard 6.1 states:

> The institution keeps abreast of emerging evaluation techniques and engages in systematic efforts to evaluate the quality of its graduates upon completion of their program of study and after they enter the teaching profession. This evaluation includes evidence of their performance in relation to program objectives (p. 11).

Standard 6.2 gives emphasis to use of evaluation results in program improvement and states:

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[1]Presented before the Annual Meeting of the National Association for Research in Science Teaching, Atlanta, Georgia, March 22, 1979.

> The institution regularly evaluates its teacher education programs and uses the results of its evaluation in the modification and improvement of those programs (p. 11).

In 1970, in order to meet the NCATE standards, gather curriculum evaluation data and sufficient information for curriculum development and reform, the College of Education of Tennessee Technological University initiated a series of systematic studies of the graduates of the teacher education programs. The general objectives of the evaluation programs at the University include the following:

1. To evaluate the objectives of the teacher education program of the University through a systematic study of the graduates.
2. To provide information for faculty and administration concerned with teacher education programs at the University in making decisions pertinent to curriculum evaluation and development.
3. To aid in the process of making long-range plans for improving the total program of the University with particular emphasis on teacher education.

Three broad types of studies have been conducted at the University since 1970: (1) systematic surveys of the graduates of the teacher education programs and employers of the graduates, (2) special studies designed to provide specific information about a particular area of concern, and (3) implementation of the Tennessee Technological University Teacher Evaluation Model. Studies under groups 1 and 2 were begun in 1970 and use of the Evaluation Model was begun in 1973. Figure 1 shows a flow chart of the major activities in program development, operation and evaluation in teacher education at the University.

The purpose of the remainder of this paper is to describe the Tennessee Technological University Teacher Evaluation Model, its use in program development and improvement, and to present the results of the application of the model to a group of 20 individuals who were teaching science. It should be noted that the model is of a general nature and no

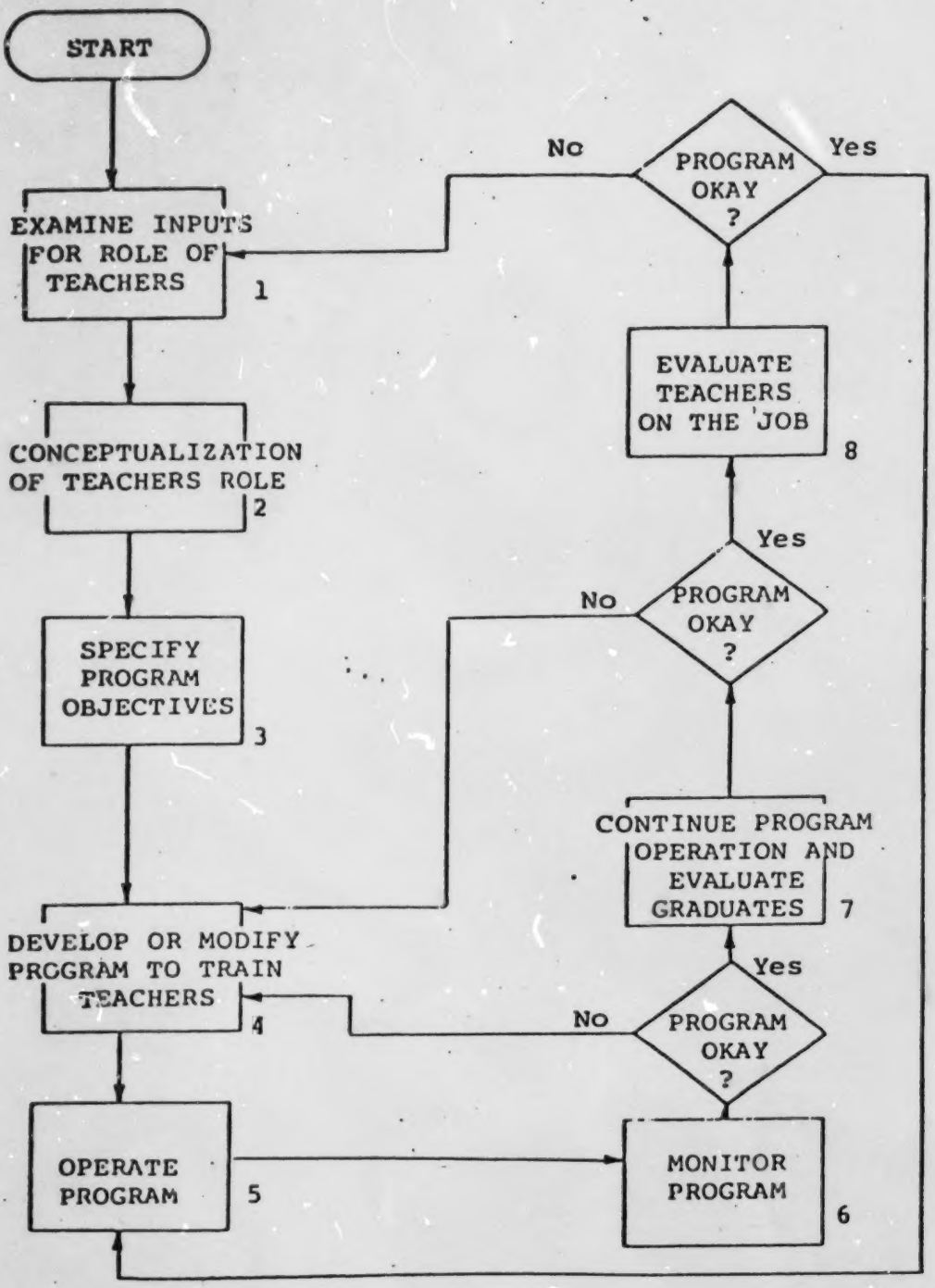

Figure 1. Flow Chart of Major Activities Involved in Program Development, Operation and Evaluation.

attempt was made as a part of the original design to specifically gather evaluative information about science teachers.

Tennessee Technological University Teacher Evaluation Model

In a monograph prepared for the American Association of Colleges for Teacher Education, Sandefur (1970) suggested a model for evaluating the product of teacher education programs. This model was based on generalizations made from the research literature on effective teaching and included:

1. Good teaching utilizes the maximal involvement of the student in direct experiential situations.
2. Good teaching encourages maximal "freedom" for the student.
3. Good teachers tend to exhibit identifiable personal traits broadly characterized by warmth, democratic attitude, affective awareness, and a personal concern for students (pp. 4-8).

Sandefur (1970) suggested procedures and instrumentation for conducting a product evaluation of teacher education programs.

In 1973, Tennessee Technological University developed and implemented a longitudinal study based on Sandefur's general model for systematic data gathering and for making decisions about its programs in teacher education. In 1978-79, the study entered its sixth year. The purpose of the study has been to adapt Sandefur's basic model for evaluation of teacher education graduates of the University and to apply the results of the study to the process of making long-range plans for improving the total educational program of the University with particular emphasis on the teacher education programs (Ayers, 1974, 1975, 1976a, b, 1977, 1978).

The basic evaluation model at Tennessee Technological University provides input data from four broad sources including graduates of the teacher education program, their supervisors (principals), their pupils, and independent observers. Perhaps the most valid criticism of the model,

and the one that is of greatest importance, is its failure to use pupil gain as a criterion of teacher effectiveness. However, because of the extreme complexity of using pupil gain as an evaluative criterion, the model has been limited to measures of teacher behavior based, insofar as possible, on research inferences and the generalizations derived from the research literature. Moreover, the evaluative instruments used in the model are those which have been demonstrated effective in reputable studies and which promise, in a reasonably reliable way, to measure the generalizations formulated as the rationale of the model. Following is a brief description of the instruments and methods used for collecting data from the four basic sources.

Graduates

Career base-line data including such variables as teaching experience and demographic information, course ratings, ratings of the level of achievement of objectives of the teacher education program of the University, and self-ratings of teaching ability are collected from a sample of graduates by use of questionnaires. Quality point averages, courses completed, and standardized test scores from such instruments as the National Teacher Examinations, are obtained from University permanent records and a measure of the graduates' personality is obtained by administration of the California F-Scale Forms 45 and 40.

Supervisors

Principals' evaluations are obtained using the Teacher Evaluation by Supervisor Instrument (Sandefur, 1970) developed at Kansas State Teachers College. This instrument allows for the rating of the subjects in four areas: (1) subject matter competence, (2) relations with students, (3) appropriateness of assignments and academic expectations, and (4) overall

classroom effectiveness. A second instrument, also completed by the principals, is designed to obtain a rating of the level of achievement by the graduates of the objectives of the teacher education program.

Pupils

There is considerable evidence that pupil evaluations of the teacher is a valid source of information. Therefore, the Student Evaluation of Teaching (SET) developed by Veldman and Peck (Veldman, 1970) is utilized to obtain five dimensions of teacher behavior in grades 4-12. These dimensions are:

1. Friendly and Cheerful
2. Knowledgeable and Poised
3. Lively and Interesting
4. Firm Control
5. Non-directive (Democratic Procedure)

A second version of the instrument is used in grades K-3 (Haak, Kleiber & Peck, 1972).

Independent Observers

Two direct classroom observation systems are employed in the model including: (1) a ten-category system of interaction analysis (Amidon & Flanders, 1971) and (2) the Classroom Observation Record (COR) developed by Ryans (1960).

The ten-category interaction analysis system is used by trained research assistants to assess in a quantifiable manner the behavior of teachers and students engaged in the teaching-learning process. The system consists of seven categories of teacher talk, two categories of student talk and a non-verbal category. As is customary in most interaction analysis systems, the observer records the occurrences of each category every three seconds or each time the category changes. Observers are trained until their interobserver reliability coefficient is .75 or higher.

The COR measures four dimensions of student behavior and 18 dimensions of teacher behavior. Each dimension of pupil and teacher behavior was carefully described and defined in a glossary accompanying the recording form. A polarized seven-point interval is used by the research assistants to rate each pupil and teacher behavior dimension. Additional research studies of the use of the instrument at the University has lead to the conclusion that the instrument is measuring three factors (Ayers, 1978). These factors correspond closely to the original work of Ryans (1960).

Data Collection

Collection of data with the above instrumentation is being accomplished in two ways. First, extensive use has been made of the mail for collecting initial data from graduates of the teacher preparation programs. Also, this has allowed for making contact with graduates after they have entered the teaching profession. Initially, all graduates are contacted in the fall of the year after graduation for the collection of initial demographic information. In turn, those graduates that are teaching within a 100-mile radius of the University are asked to participate in the longitudinal study. For the past six years about 55 graduates (each year) at both the bachelor's and master's levels have volunteered to participate in the study.

These graduates are visited by specially trained graduate assistants for purposes of collecting additional data. The assistants spend approximately a half day in each participant's classroom completing the observation instruments, interviewing the graduates and principals, and collecting data from the pupils of the graduatee. All data are synthesized and prepared for computer processing. Figure 2 shows a summary of data

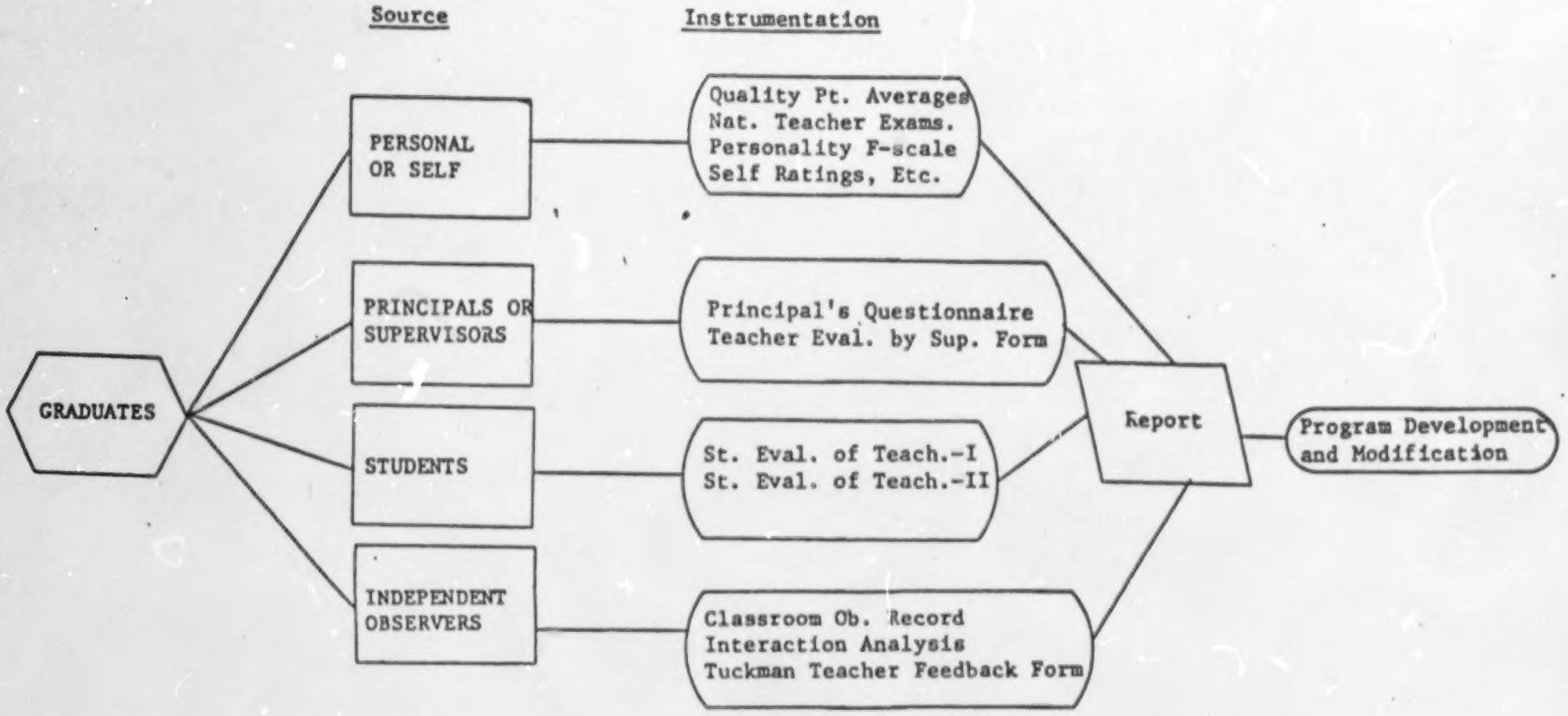

Figure 2. Summary of Sources of Data, Instrumentation and Use of Data.

sources, instrumentation and use of the data and Figure 3 shows a PERT chart of the major activities of the project for 1978-79.

Application of the Model to Science Teachers

The model presented in the previous section is designed to be used with graduates from most any teaching area. In the evaluation efforts that have been conducted over the past six years at Tennessee Technological University, no particular effort has been made to identify specific groups of individuals for study, e.g., teachers of English, social studies, health, physical education, and home economics. However, in the course of the operation of the project, 20 individuals (in their first year in the study) were identified whose major teaching assignments were in an area of science. Six individuals had completed the Master of Arts and 14 the Bachelor of Science. Two individuals were teaching science in departmentalized grades four or five and the remainder were in grades 6-9 (with an almost equal distribution among the four grade levels). Two individuals indicated they were teaching earth science, one biology and the remaining indicated they were teaching general science. Only three individuals had completed a formal course of study that led to certification as elementary teachers[2] and were engaged in the instruction of science. The mean number of quarter hours of college credit completed

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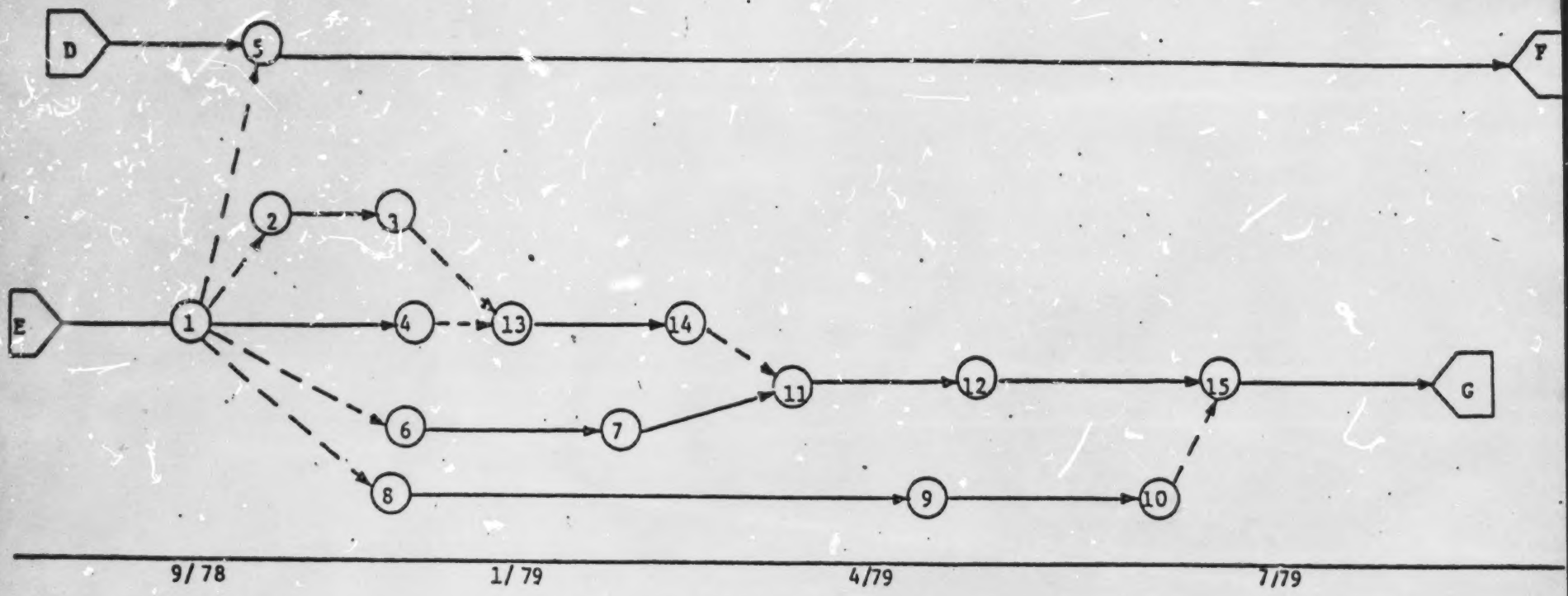
[2]Prior to September 1, 1977, elementary teachers were certified to teach all subjects in grades 1-9. After September 1, 1977, elementary teachers were certified for grades 1-8 and teachers in the upper elementary grades must hold certification in a specific certification area if the school is departmentalized.



Summary of Activities

1-4	Finalize Plans for Visiting Subjects in 1974-77 Phases of Study
2-3	Training of Observers
5--	Continuing Contact With Other Projects and Survey of the Literature
6-7	Survey All 1978 Graduates
8-9	Conduct Other Related Studies
9-10	Prepare Reports of Related Studies
7-11	Select Sample of 1978 Graduates for Intensive Study as Part of Followup
11-12	Make School Visits on 1978 Graduates
13-14	Make School Visits on 1974-77 Graduates
12-15	Complete Reports and Submit
15---	Begin Making Plans for 1979-80 Phase of Study

Figure 3. PERT Chart of Major Activities for 1978-79.

in science by those individuals certified as elementary teachers was 21 hours with a range from 18 to 34. The majority had completed only college work in biology. Following are comparisons of these individuals teaching science with all first year individuals for the period 1973 through 1977. There were no significant differences among the science teachers, e.g., M.A. and B.S. graduates or fully certified in science versus those with other certifications.

Career-Base Line Data

Graduates primarily teaching science had achieved an overall undergraduate average of 2.99, 3.17 in education and psychology courses, and 3.20 in their major teaching field. These averages were comparable to or above those for the total group (N=161). Mean scores (about 570) on the Weighted Commons section of the National Teacher Examinations indicated that the science teachers and total group had achieved at about the 50th percentile. There were no significant differences among the groups.

The graduates teaching science achieved a mean score of 109.7 (SD=20.4) on the California F-scale. The composite group of 153 achieved a score of 103.5 (SD=19.8). The t-test (t=1.28, df=171) indicated no significant differences among the groups. The individuals teaching science tended to be less democratic and more authoritarian in their beliefs. Individuals with low dogmatism scores are more likely to use indirect methods in teaching than those with more closed-minded attitudes (Sandefur, 1970).

Supervisors Ratings

Table 1 shows a comparison of the ratings by the principals of the science teachers with the total group. In general the science teachers were rated slightly lower than the total group of graduates. This finding

is not surprising since the graduates as a whole were teaching in a specialized area in which they may not have had adequate preparation.

Table 1

Comparison of Supervisor's Ratings

Dimension	Science Tchrs (N=20) $\bar{X}$	SD	All Tchrs (N=157) $\bar{X}$	SD	t
Subject Matter Competence	4.0	0.7	4.1	0.6	0.60
Relations with Students	4.2	0.7	4.3	0.7	0.59
Appropriateness of Assignments	4.0	0.7	4.2	0.6	1.19
Overall Effectivenss	4.2	0.7	4.1	0.6	0.60

Pupils

Evaluation by pupils resulted in the largest overall differences in data collected for the sub-group of science teachers and the total group. Table 2 shows a comparison of scores achieved by the two groups on the Student Evaluation of Teaching. In general, the students did not rate the science teachers as high as the total group was rated. Significant differences were noted on the factors of Friendly and Cheerful, Lively and Interesting and Non-Directive (Democratic procedure).

The ratings may be attributed in part to the nature of the material being taught, in other words, science. In general, science has been a neglected area in the middle school grades in the geographic vicinity of the followup study. Therefore, the ratings given by the students to the science teachers may reflect the students feelings toward science rather than their true feelings toward the teachers.

Table 2

Comparison of Student Evaluation of Teaching Scores

Factor	Science Tchrs (N=20)		All Tchrs (N=87)		t
	$\bar{X}$	SD	$\bar{X}$	SD	
Friendly and Cheerful	317	42.0	339	43.3	2.10*
Knowledgeable and Poised	324	34.3	336	35.4	1.40
Lively and Interesting	272	35.6	299	36.8	3.03**
Firm Control (Discipline)	304	39.0	300	38.5	0.41
Non-Directive (Democratic Procedure)	221	43.4	254	43.2	3.06**
Composite Score	287	35.7	307	33.7	2.28*

* $p<.05$
** $p<.01$

Independent Observers

A comparison of the results of the administration of the ten-category system of interaction analysis is shown in Table 3. In general, the science teachers were using less indirect to direct teaching than the total group of teachers. The science teachers appeared to be lecturing more than the total group of teachers.

Table 4 shows a comparison of the factor scores achieved by the science teachers and the total group. Again, the science teachers were rated slightly lower on all factors than the total group of teachers.

Results and Discussion

This section is divided into two parts. The first part contains a general discussion of the results of the implementation of the evaluation model and its effects on Tennessee Technological University. The second part presents a brief discussion of the results of the application of the

Table 3

Comparison of Interaction Analysis Ratios

Ratio	Science Tchrs (N=20)		All Tchrs (N=156)		t
	$\bar{X}$	SD	$\bar{X}$	SD	
Indirect/Direct Tchg (i/d)	0.52	1.00	0.93	1.32	1.55
Indirect/Direct Tchg (I/D)	2.10	2.91	2.51	3.02	0.55
Student Talk/Tchr Talk (ST/TT)	0.49	0.62	0.67	0.73	1.12
Silence/Total Tchg (Sil/Tot)	0.34	0.68	0.39	0.67	0.29
Lecture/Total Tchg (Lec/Tot)	0.58	0.30	0.44	0.20	1.61

Table 4

Comparison of Classroom Observation Record Factor Scores

Factor*	Science Tchrs (N=20)		All Tchrs (N=155)		t
	$\bar{X}$	SD	$\bar{X}$	SD	
I	42.5	4.9	41.8	5.0	1.01
II	65.3	3.2	65.7	3.3	0.56
III	21.4	3.1	22.2	3.0	0.49

*Factor I, responsible, systematic, businesslike versus evading, unplanned, slipshod behavior; Factor II, kindly, understanding, friendly versus aloof, egocentric, restricted teacher behavior; and Factor III, student behavior.

model to the group of 20 individuals teaching science.

Tennessee Technological University Teacher Evaluation Model

Results of the study have indicated that the graduates who have been followed for as many as five years have changed little during the period. Few significant differences have emerged from the data. Therefore, it could possibly be concluded that a teacher's style may be developed early in his career in the classroom. Also, there have been few differences

noted when comparing each group of first year graduates across five years of the study. When comparisons of the data were made with that reported in the literature, the graduates appeared to be at a level comparable to or above the 50th percentile and were exhibiting many of the characteristics of good teachers. It appeared that two of the best predictors of success in teaching were level of achievement on the Professional Education Test of the National Teacher Examinations and overall grade point average in professional education and psychology courses. Less authoritarian graduates appeared to be overall better classroom teachers. The graduates appeared to have deficiencies in such areas as classroom control, cognitive knowledge in mathematics, insight into the characteristics of behavior of children and effective use of community resources.

The results of the study have been used in program development and improvement at the University. Figure 1 shows the cyclic process in use at the University to accomplish this process. Reports of all studies have been disseminated to all faculty in teacher education, members of the Teacher Education Committee, University administrators and other interested individuals. Meetings have been held for the purpose of discussing the results of these studies, with the departments involved and with other groups. The purpose of this wide dissemination of the reports has been to make the information readily available to those that are involved in developing, implementing and improving the programs of teacher preparation. A special curriculum study committee has been formed from the faculty within the teacher preparation programs of the University. This group has been charged with the responsibility of examining the results of the studies in depth. Following is a partial

list of some of the changes and improvements that have been made in the teacher preparation programs of the University.

1. Addition of more practicum and laboratory experiences into the teacher preparation program of undergraduates. Included under this broad area was more contacts in working with children in the schools.

2. The course, "Introduction to the Teaching Profession," (a freshman level course) was reorganized and made more practical and less theoretical.

3. Overlap and duplication among courses was eliminated.

4. Courses in the areas of history, philosophy and social foundations of education were modified.

5. Secondary education major fields have been redesigned to include broad comprehensive teaching fields and sociology and geography were eliminated as separate teaching fields.

6. Course work in the Department of Educational Psychology and Counselor Education is being redesigned and placed on a competency basis.

7. Methods instructors have become more active in the public schools through actually assuming the role of the classroom teacher.

8. Modifications in the requirements for a major in elementary education have taken place and the total program has been made more field oriented.

The basic model outlined in this paper has application for providing information for the use by colleges and universities in improving their programs in teacher education and for school systems in their evaluation of teachers for improving the overall quality of education. The model provides for the accumulation of information about the processes and procedures that are being used in an individual teacher's classroom. In turn, feedback information can be given to individual teachers and the overall teaching process can be improved.

Although many of the procedures outlined in this basic model have been available for a number of years, few agencies have attempted to put these together to form a logical whole for the development and improvement

of the teaching process. It is felt that most any institution or school system can implement the model or a modification of the model and in turn this can lead to improved educational opportunities for children.

Application of the Model to Science Teachers

Application of the model to the evaluation of a particular group of teachers has been a new avenue of exploration for the total project at the University. Although the data have been available for several years only cursory attempts have been made to analyze the information on a detailed basis for particular groups.

To some individuals, the results of the application of the model to a group of science teachers may be disappointing. However, it should be kept in mind that the majority of the teachers in the study who were teaching science did not have specialized training in the subject. Also the study was carried out in a geographic area that does not emphasize to a great degree science in the schools. Science instruction is on a secondary basis to most all other subject matter areas in the middle school grades. A more complete analysis of the data for the teachers does indicate that they are at least at a mean level in their instruction when compared with all teachers in the study.

Summary

This paper has described a model for the evaluation of teachers, the use of the model in program development and improvement for the preparation of teachers, and the application of the model to a special group of individuals teaching science in the middle school grades. In general, the model has proven to be a valuable tool in program improvement and development. Empirical data have been collected that has lead to improvements for the preparation of preservice and inservice teachers at

Tennessee Technological University. It has been demonstrated that the model can be applied to special groups of teachers, i.e., in data gathering that can be used for program improvement.

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